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Designing for "X" Where "X" is Renewability

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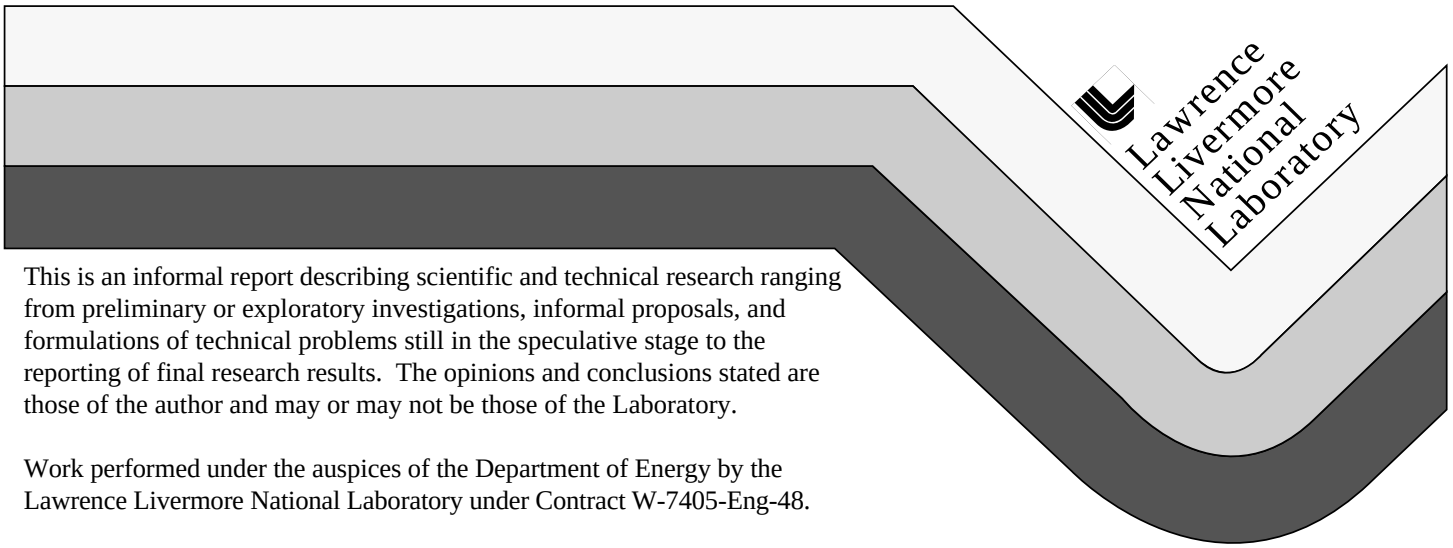

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Designing for "X" Where "X" is Renewability

by
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Post-consumer take-back requirements for high-design/low material articles is driving firms — and thus designers — to produce products more easily disassembled and recycled. Explore how design for renewability is an easily achievable objective. Design for renewability is intended to be a module of the existing design system know as design for X where X is a desirable product characteristic such as reliability, producibility, supportability, etc.

Emphasize how integrating this new design parameter into current design practices will benefit firms in a number of ways including shifting environmental compliance from an end-of-pipe liability to a proactive competitive strategy that yields measurable economic returns.

1. Introduction

Industrial Ecology, sometimes referred to as "Science of Sustainability", requires industry to rethink industrial activity and how it views the environment. Design for Environment, as part of the Design for X design practices, is one way industry is beginning to implement the vision of Industrial Ecology. For the logistics engineer the application of these practices raise many challenges. In particular, the firms and engineers need to ask, "What will environmentally efficient logistics systems for product distribution and take-back look like?" "What are the critical needs and key components that logistics systems require?" And finally, "How do these logistics systems affect and contribute to the core business of the firm?"

As we move forward with the development and implementation of industrial ecology, we need to take a closer look at the contributions of logistics systems to the environmental impact of products. Consider for example, the choices of a mail-order clothing company. If this company incorporates Design for Environment practices to fabricate environmentally sound clothing, but then decides to ship every article using overnight air freight, then "Is this, in fact, an

environmentally sound product?" With this decision, the company has increased its overall environmental impact. The company has failed to consider the total life-cycle effects and omitted to ask the fundamental question, "What is the most environmentally efficient means to get the product to the customer?" (e.g., a store vs mail-order.) The answer to this question will not only shape the logistics system of the firm, but the strategic direction and/or core business of the firm.

2. Product Take-Back

The word is out — product take back is coming — and some may argue is already here. Companies with products in global markets (almost all companies today) should take heed. In Europe, Japan (where land constraints are the same as those in Europe and the objective is to reduce flow of waste), and the USA legislators are reviewing and/or adopting schemes which call for what some are referring to as “extended product responsibility” where vendors must retrieve their wares and be responsible for the disposition of the product. In England, a quasi-voluntary policy is in the works. The Dutch have it as part of their covenants with industry. The President’s Council on Sustainable Development is also considering it. With all this activity, firms have begun to look for ways to deal with this emerging policy initiative. Logistics systems are fundamental in helping firms meet the requirements of take-back.

2.1. Objectives of Take-Back

The first take-back policy was adopted in Germany in 1991 and enacted as a packaging recovery legislation. The objective of this program was to reduce the large amount of waste generated from product packaging. Knowing that similar legislation would be ordered for other products — including cars, electronics — companies began setting up voluntary take-back schemes for products. Such voluntary schemes raised many questions about the objectives and the ability to implement take-back policies in addition to the logistical needs/structure of these systems. The question of who would pay the recovery costs remained a continuing point of contention. For example, the automobile industry called for a recovery fee to paid by the last owner of the vehicle in addition to a surcharge on the initial purchase of the new vehicle to cover the cost of recovery. This is partly due to unclear objectives and/or enforcement of take-back.

No one will deny that the overwhelming objective of the take-pack is to eliminate waste but governments and industry must ask themselves is this an

effective and reasonable means to achieve this objective. We are recently unable to address/define what would be an effective scheme. But a number of test can help in establishing whether such schemes are reasonable. The key questions we must ask to test whether a scheme is reasonable are:

1. Can the present systems constitute an unfair trade barrier (raise the scale of operations to enter market)? What are the economies of scale (scale economies tend to favor large firms)?
2. Is the take-back effective in improving environmental efficiency?
3. Is there a chance that other countries will follow suit?
4. What are the consequences/requirements for the logistics system at the macro-, meso- and occasionally the micro-economic levels?

These questions will need to asked by firms and regulators a like. Regulators will need to determine their level of responsibility in settling up an infrastructure for customers to return products. Likewise, will industry be required to take on the entire financial burden and logistics infrastructure to support the retrieving and disposing of their products? This will be the cost for the firm to enter the market. Large firms will undoubtedly be favored here since small and medium companies will have to rely on whatever collective infrastructure may be available.

2.2. Take-Back Schemes (packaging, product — electronics & auto)

In understanding the requirements/needs of the firm’s product & logistics designers, let’s begin by reviewing the various take-back schemes. Two types of schemes can be noted: 1) leasing systems and 2) the "one-for-one" system (i.e. take back one unit for every unit you sell).

With the leasing system (e.g. automobile leasing, computer leasing), the customer acquires the product; uses it for its particular function and then returns it to the vendor and/or the facilitator of the lease. Inherently, the leasing system creates a challenging design assignment for the product and logistics designer — identify & design to effective provide the service/function the customer desires, in other words, a renewable product for multiple users.

The one-to-one system, creates the most incentive to improve designs yet it is questionable whether there is incentive for environmentally efficient designs which eliminate waste entirely and/or produce reusable or recyclable products.

"One-for-one" systems require the recovery of one unit for every unit sold. In general, this system requires vendors to take-back their own brands. A number of

firms are finding strategic value in offering product recovery services to their customers. For example, Dell Computer has employed an Asset Recovery program which is part of their sales strategy.

Firms will be faced with developing strategies and infrastructure to address both the logistics and cost of extended product responsibility. Global firms will have an even greater challenge as systems look different from country-to-country. Firms with the insight to recognize the value innovative and creative logistic strategies will benefit the most.

3. Design for "X"

A product's impact on the environment is determined by many factors — its design and composition, the processes used to produce it, the way it is used, how the product is packaged (including transport and installation) to the customer and lastly, the manner of its disposal. These are known as the life-cycle stages of the product and all contribute to the overall environmental impact of the product. Designing and developing environmentally responsible products minimize the impacts on the environment at all the different life stages; and employing design practices like Design for Environment, Design for Recyclability, Design for Disassembly will benefit firms in developing a proactive environmental strategies are competitive in the marketplace.

3.1. Challenges for the Designers

Environment, Recyclability, Renewability — The consequence of not considering these factors in design can be illustrated by a Carnegie Mellon research project on computer disposal which cites that by the year 2005 there will be some 150 million obsolete personal computers. The required landfill volume is more than 8 million cubic meters and the associated landfill cost, some $400 million. Consider this along with the washing machine, refrigerators, automotive parts & plastics and the long list of products now in use and not designed for recycling — the quantity of unrecoverable material becomes enormous. Logistics systems to accomplish the recovery of such vast quantities of products will be substantial and complex. In the context of emerging take-back, employing Design for Environment, Recycling, Renewability which encourage the modular design of products, the use of recycled material, energy-efficient designs, etc., become crucial to the firm.

These design features will benefit future logistics systems, yet existing systems will require clever mechanisms and strategies for recovery of obsolete products. To develop effective logistics systems, engineers will need to understand the environmental impact of their existing distribution system and the need to reverse the direction of the system for product recovery. You will need to identify where the maximum environmental improvement are to be made. Once the product has been recovered, what (disposition) options are available to the firm. In the effort to use less resources, the preferences are to reuse or recycle the product. Logistics systems which offer multiple options to the firm promise to provide the most environmentally efficient strategies.

Features like modular design allows for quick & easy upgrades for customers. Today's computer industry with its rapid growth and innovation represent possibilities for modular design. As we all anxiously await the next generation of processor chips, we do not want to have to replace our entire computer system. Doing so means additional financial investment associated with that nagging question of "What to do with the old machine?" and the environmental burden (and cost) of disposition. Modular designs which give us the ability to upgrade products by exchanging modular components/parts and should not involve the purchase of redundant components.

3.2. Challenges for Logistics Engineers

For the logistics engineer, the DFX practices not only help minimize the environmental impact but can form strategic possibilities by assisting the firm in:

- Reducing life-cycle cost
- Managing product transitions
- Offering a value-added service.

Objective is to provide multiple options to the firm. Few firms have addressed the environmental factors associated with logistics systems. What is environmental logistics and its aspects? Understanding the logistics change affected by accelerated product evolution and the resulting increase in product obsolescence create the context to establish effective reverse logistics systems. What is desirable are reverse systems which are similar to product distribution systems and encourages customers to select your firm/product based on the invaluable service you offer as well as for its environmental soundness, resulting in a competitive advantage for your firm. In essence, the challenge to the logistics

engineer is to develop and offer a the service and infrastructure to support the influx of products returning to the firm.

4. Conclusion

This address has left you with a lot more questions than answers. As logistics professionals you are challenged to apply your expertise to develop distribution channels that take into account the environmental impact of the choices you make but more importantly to craft reverse distribution channels which do the same. How can this distribution channel become lucrative and strategic for your firm, and at the same time, be environmental efficient from an overall social point of view?

A number of firms (e.g. Dell Computer) are using the skills and knowledge of logistics personnel to create market differentiators between them and their competitors. Asset Recovery Programs, where companies take responsibility for the disposition of obsolete equipment for their customers are removing a tremendous burden for the customer and represent the strategic nature of environment in the economic prosperity of the firm.